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The Pupa of *Lotisma trigonana* and Some Characteristics of the Copromorphidae (Lepidoptera)

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Abstract. The pupa of *Lotisma trigonana* (Walsingham), one of two Nearctic copromorphid genera, is described. Comparisons with the pupae of two other Copromorphidae indicate that positions of head and thoracic features and movable abdominal segments 5-10 are characteristic of the family. Rearing observations indicate that larval feeding mode, hostplant family, cocoon construction, and overwintering stadium are variable among the Copromorphidae.

Introduction

Even though Mosher (1916) recognized its value in determining taxonomic affinities over a half century ago, the pupa rivals the egg as the most neglected stadium in descriptions of Lepidoptera. There are few or no descriptions of the pupae of many genera and several smaller families. Consequently, characterization of the pupae of many groups is difficult or impossible on the basis of published information alone. Such is the case with the Copromorphidae, a small tropical family, with only two Nearctic genera.

Prior to the transfer of *Lotisma trigonana* (Walsingham) to Copromorphidae (Heppner, 1978), that family was not thought to be represented in the Nearctic region. Subsequently, a second Nearctic genus, *Ellabella* Busck, was transferred to Copromorphidae (De Benedictis, 1984). In that paper, the pupa of *Ellabella bayensis* Heppner is described and illustrated, but apparently few or no other copromorphid pupae have been described in detail. Fletcher (1933, pl. xv), for example, illustrated the pupa of an Indian species, *Copromorpha myrmecias* Meyrick, but it lacks detail, and there is little descriptive information in the text.

The pupa of *L. trigonana* is described here and compared to that of *E. bayensis*. Because the Copromorphidae are poorly known, I also describe some observations from collecting and rearing both species.

Material Examined

I obtained larvae of *L. trigonana* by collecting whole inflorescences of madrone, *Arbutus menziesii* Pursch (Ericaceae), on a ridge two miles

north of Alpine Lake, Marin County, California, on April 16, 1983. The larvae are well concealed in the inflorescences, terminal panicles of dense racemes of small, creamy-white flowers. Except for a black head capsule and cervical shield, a small reddish dorsal anal patch and, occasionally, two faint subdorsal lines, flower-feeding *L. trigonana* larvae are almost exactly the same color as madrone flowers. They usually feed within the urn-shaped flowers, so frass-fouled silk which ties together several flowers provides the best visual evidence of the concealed larvae.

There were four or five species of Lepidoptera larvae in the inflorescences. Those matching the description of *L. trigonana* larvae by MacKay (1972) were isolated from the other larvae and reared on cut flowers in plastic bags. Other species included one or two species of geometrids which I was unsuccessful in rearing and two eucosmine Tortricidae, *Epinotia emarginana* (Walsingham) and *E. terracoctana* (Walsingham).

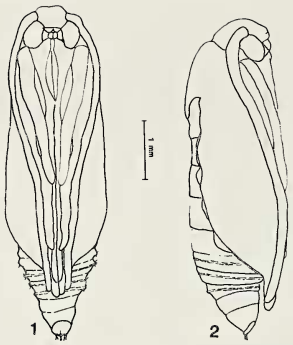
Four larvae and two pupae of *L. trigonana* were preserved by boiling in water then transferring to 95% ethanol. Twenty adult moths emerged from the remainder of the lot between May 6 and June 1, 1983, two to four weeks after pupation.

The frail pupal shell turned transparent in alcohol which made examination of morphological features difficult, so drawings were made from a live pupa with the aid of a camera lucida attached to a Wild binocular dissecting scope. Later, the pharate adult became visible which facilitated the identification of the morphological features of the pupa.

Description of the Pupa (Figs. 1 & 2)

Length: 5.3-5.5 mm; somewhat pliant, but frail; appearing white except eyes pink in young pupae, darkening to black later. **Head:** Frons somewhat flattened apically; antennae extending to wing tips at anterior margin of A9, not meeting along ventral meson; eyes prominent; pilifers present as small lobes mesad of eyes; maxillary palpi present as triangular lobes posterio-laterad of eyes; haustellum extending from eyes and pilifers nearly to wing tips; labial palpi along ventral meson from clypeus to mid-metathorax. **Thorax:** Prothorax narrow, collar-like; mesothoracic wings extending to anterior margin of A9, not meeting along ventral meson and free from A5-9; metathoracic wings almost entirely concealed; forelegs extending to A3, nearly meeting at ventral meson; mesolegs laterad of forelegs, extending to middle of A6; tarsi of hindlegs visible between wing tips caudad of haustellum. **Abdomen:** A1-4 slightly longer than caudal segments; A5, 6, and 7, and 8-10, as a unit, movable; A5, 6, and 7 encircled with mid-segmental ridge; spiracles inconspicuous, on protruding lobes on A2-4; cremaster of seven setae, six in a caudal row, one more anteriad on ventral meson.

Remarks: The pupal shell is somewhat pliant, but delicate and easily damaged by handling. The mid-segmental ridge on segments A5-7 probably strengthens them. There are some very fine paired setae in lateral rows on A5-7 and on the dorsum of A7 and 8. These setae usually broke when the pupa was extracted from its cocoon and were easily confused



Figs. 1 & 2. Pupa of *Lotisma trigonana* (Walsingham). **1.** Ventral aspect. **2.** Lateral aspect. (Vertical line = 1.0 mm).

with remnants of silk, so exact numbers and locations of setae could not be determined. Some may have been overlooked. These setae clearly were not strong enough to anchor the pupa to the cocoon. The abdomen lacks true spines and spurs. The pupal shell does not protrude from the cocoon when the adult emerges. The movable abdominal segments telescope into the anterior segments upon adult emergence.

Discussion

Although the larval description by MacKay (1972) was adequate for identification, the larvae I collected differed in that the pinnacula were poorly differentiated and less conspicuous than those in her illustration. The semicircular submental lobes, which she suggested are characteristic of the family, were very small and could easily be overlooked.

In addition to madrone, known larval hostplants of *L. trigonana* larvae are several other members of the heather family (Ericaceae). These include fruit and flowers of manzanitas (*Arctostaphylos* spp.), salal (*Gautheria shallon* Pursh), and evergreen huckleberry (*Vaccinium ovatum* Pursh) (Llewellyn-Jones, 1937; Powell, unpubl. rearing notes).

Larvae in my collection which matured after the cut madrone flowers wilted were provided with manzanita berries into which they bored or fed upon externally. Unlike the larvae which matured while feeding upon flowers, fruit-feeding larvae were almost entirely reddish in color rather than creamy-white with reddish markings. The reddish color was very similar to that of the berries.

Feeding mode and hostplant family is variable among the Copromorphidae. *Ellabella bayensis* feeds externally upon the flowers and, from rolled shelters, on foliage of coastal barberry, *Mahonia pinnata* (Lagasca) Fedde (Berberidaceae) (De Benedictis, 1984). *Copromorpha myrmecias* bores into twigs of figs, *Ficus* spp. (Moraceae) (Fletcher, 1933).

The cocoon of *E. bayensis* is a rolled leaf lightly lined with silk (De Benedictis, 1984) while that of *L. trigonana* is a fluffy mass of loose, cream-white to buff silk spun in crevices or between overlapping leaves. Fletcher (1933) states that *C. myrmecias* pupates within the larval burrow but does not mention a silken cocoon.

The pupae of *L. trigonana* and *E. bayensis* both exhibit head and thoracic features at approximately the same locations. Both species have the same movable abdominal segments and bear the spiracles of A2 and 3 on triangular lobes. Such lobes are visible in the illustration of the pupa of *C. myrmecias* as well (Fletcher, 1933, pl. xv). The spiracles of A4 on *L. trigonana* are also borne on such lobes.

Fletcher's (1933) illustration of the pupa of *C. myrmecias* depicts more dorsal setae than are present on either *L. trigonana* or *E. bayensis*. Such differences suggest that positions of pupal setae vary at the generic or specific level.

Fletcher (1933) does not mention whether the pupal shell of *C. myrmecias* protrudes from the larval burrow, but non-protrusion, the absence of true spines and spurs, and the concentration of the setae of the cremaster at the tip of the terminal abdominal segment probably are characteristic of the entire superfamily Copromorphoidea.

The apparently more heavily sclerotized pupal shell and tighter cocoon of *E. bayensis* may be adaptations to its overwintering as a pupa. Emergence data and flight records of adult *L. trigonana* suggest that it overwinters as an adult.

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